III. "On the degree of uncertainty which Local Attraction, if not allowed for, occasions in the Map of a Country, and in the mean figure of the Earth as determined by Geodesy: a method of obtaining the mean figure free from ambiguity, from a comparison of the Anglo-Gallic, Russian, and Indian Arcs: and speculations on the Constitution of the Earth's Crust." By the Venerable J. H. PRATT, Archdeacon of Calcutta. Communicated by Professor STOKES, Sec. R.S. Received Oct. 5, 1863.

(Abstract.)

After referring to a former paper in which he had shown that, in the Great Indian Arc of meridian, deflections of the plumb-line amounting to as much as $20''$ or $30''$ would be produced if there were no sources of compensation in variations of density beneath the surface of the earth, and after alluding to a remarkable local deflection which M. Otto Struve had discovered in the neighbourhood of Moscow, the author proceeds to consider, in the first instance, the effect of local attraction in mapping a country according to the method followed by geodesists, in which differences of latitude and longitude are determined by means of the measured lengths of arcs, by substituting these lengths and the observed middle latitudes in the known trigonometrical formulæ, using the *mean* figure of the earth, although the actual level surface may differ from that belonging to the mean figure in consequence of local attraction. He concludes that no sensible error is thus introduced, either in latitude or longitude, if the arc do not exceed $12\frac{1}{2}°$ of latitude or $15°$ of longitude in extent, but that the position of the map thus formed on the terrestrial spheroid will be uncertain to the extent of the deflection due to local attraction at the station used for fixing that position. In the Great Indian Arc this displacement might amount to half a mile if the deflections were as great as those calculated from the attraction of the mountains and the defect of attraction of the ocean, irrespective of subjacent variations of density; but the author shows in the next two sections that some cause of compensation exists which would rarely allow the actual uncertainty to be of any considerable amount, unless the station used for fixing the map were obviously situated in a most disadvantageous position.

The author then proceeds to examine the effect of local attraction on the mean figure of the earth, considering more particularly the eight arcs which have been employed for the purpose in the volume of the British Ordnance Survey. He supposes the reference station of each arc to be affected to an unknown extent by local attraction, and obtains formulæ giving the elements of the mean figure obtained by combining the eight arcs, these formulæ involving eight unknown constants expressing the deviations due to local attraction at each of the selected stations. By substituting reasonable values for the unknown deflections, he shows that local attraction s competent to affect the deduced mean figure to a very sensible extent.

He then institutes a comparison between the results afforded by those three of the eight arcs which are of considerable extent, namely, the Anglo-Gallic, Russian, and Indian Arcs. For each arc in particular he deduces values of the principal semiaxes of the earth, involving an unknown constant expressing the effect of local attraction at the reference station of the arc. In order that the three pairs of semiaxes should agree, there are four equations to be satisfied by means of three disposable quantities (namely, the three unknown attractions). On combining these four equations by the method of least squares, the unknown deflections come out extremely small, and the values of each semiaxis deduced for the three arcs separately come out very nearly equal to one another, and therefore to their mean. These mean values the author ventures to assume are the mean semiaxes of the earth. They are as follows:—

$$a=20926180,\ b=20855316 \text{ feet, giving } \epsilon=\frac{1}{295\cdot 3},$$

where a is the equatorial, and b the polar semiaxis, and ϵ the ellipticity.

The author concludes with certain speculations respecting the constitution of the earth's crust. On adopting the mean figure determined as above explained, the errors of latitude to be attributed to local attraction at each of the fifty-five stations of the eight arcs, which will be found at p. 766 of the Ordnance Survey volume, come out very small. With respect to the Great Indian Arc, it is especially remarkable that the residual deflections are insignificant, while those calculated from the action of the causes visibly at work are considerable. It would seem as if some general cause were at work to increase the density under the ocean, and diminish the density under mountainous tracts of country. The author conceives that, as the earth cooled down from a state of fusion sufficiently to allow a permanent crust to be formed, those regions where the crust contracted became basins into which the waters ran, while regions where expansion accompanied solidification became elevated without any consequent increase in the total quantity of matter in a vertical column extending from the surface down to a given surface of equal pressure in the yet viscous mass below. The author considers that the deviations of latitude at the other principal stations of the measured arcs, if not positively confirmatory of, are at least not opposed to this view.

IV. "On the Meteorological Results shown by the Self-registering Instruments at Greenwich during the extraordinary Storm of October 30, 1863." By James Glaisher, F.R.S., F.R.A.S., &c. Received November 23, 1863.

In the year 1841 Osler's anemometer was erected at the Royal Observatory, Greenwich, and from that time, up to the year 1860, the greatest pressure on the square foot recorded was 25 lbs. In February 1860 one of 28 lbs. was registered, which was the greatest up to October 30 of the present year; on that day a pressure of no less than $29\frac{1}{2}$ lbs. took place